THE TRYPANOSOMES FOUND IN TWO HORSES NATURALLY INFECTED IN THE GAMBIA

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(*Received for publication* 30 *September*, 1911)

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I. ORIGIN OF THE STRAINS

In June, 1911, we were enabled to obtain trypanosomes from two horses, naturally infected in the Gambia. For the first strain we are indebted to Professor Todd, who kindly sent to Runcorn a polo pony, *Horse A*, with a natural infection. Trypanosomes were found in the blood of this animal for the first time in March of this year. For the second strain we are indebted to Sir John MacFadyean, who kindly supplied us with a mouse infected from a horse, *Horse B*, brought to him from the Gambia by Mr. Foster, F.R.C.V.S. By the courtesy of the latter we were permitted to make films from the blood of this horse on its arrival in Liverpool. In this animal the first history of illness dates from about the middle of April, 1911, and trypanosomes were found in its blood for the first time on the 6th of May.

II. MORPHOLOGY OF THE TRYPANOSOMES IN THE BLOOD OF THE TWO HORSES

The parasites found in films made from the blood of the two horses immediately upon their arrival in Liverpool presented remarkable morphological differences. In fact the trypanosome observed in *Horse A* was easily distinguishable morphologically from that infecting *Horse B*. In the former the parasites were of considerable length, uniform, and were furnished with a distinct free flagellum, whereas in the latter they were much shorter and no free flagellated forms were found. In view of this observation we decided to study in detail the parasites infecting each of the animals.

A. *Characters of the trypanosome infecting Horse A*. When examined in fresh preparations the parasite exhibited remarkable activity, dashing across the field of the microscope in a manner strongly suggestive of *T. vivax*. In films fixed in absolute alcohol and stained with Giemsa's solution, the trypanosomes appear to be remarkably uniform in length. The posterior portion of the parasite is broad, and the body gradually tapers towards the anterior end. The nucleus lies near the centre of the animal, but anterior to the broadest portion of the body; it is, as a rule, well defined, but occasionally somewhat diffuse. The blepharoplast, round and distinct, is situated either laterally close to the posterior extremity, or terminally; the membrane is simple and narrow. The parasite has a well-marked flagellum, the free portion varying from 4 μ to 7 μ. As will be seen from Table I, the length* of the trypanosome varies from 17·1 μ to 25·4 μ with an average of 20·6 μ.

In addition to the form just described, occasional short, non-flagellar trypanosomes are encountered. These are, however, exceedingly scarce, only two such being met with in 1,000 trypanosomes counted.

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* *Method of Measuring*. In every case the blood films were fixed in absolute alcohol and stained with Giemsa. The parasites were drawn with the aid of the Abbé camera lucida at a magnification of 2,100 diameters, and measured along the middle line of the body from the posterior extremity to the tip of the flagellum. The actual length of the parasite was then determined by dividing by the magnification. The trypanosomes were drawn as they came, only dividing forms being ignored.

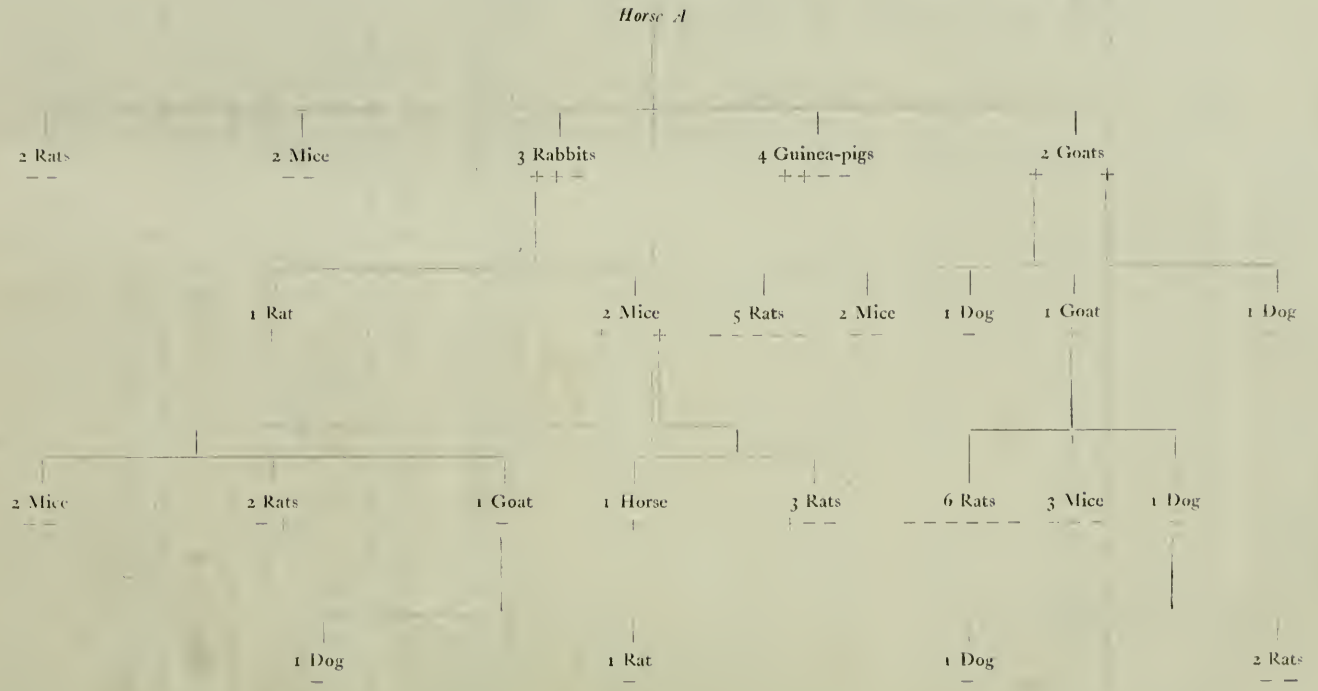
TABLE I.—Measurements of the Trypanosomes in *Horse A*

Date	Animal	No. measured	Maximum	Minimum	Average
June 3	Horse A	20	25·4	18·6	23·2
6	,,	20	23·2	14·0	19·1
9	,,	20	23·2	17·1	20·2
11	,,	20	23·8	19·0	20·6
12	,,	20	23·8	17·1	20·9
13	,,	20	24·2	11·9	21·3
16	,,	20	22·8	18·5	21·0
21	,,	20	23·0	18·0	21·2
22	,,	20	23·8	12·8	20·0
23	,,	20	22·3	18·5	20·1
Total		200	25·4	11·9	20·6

B. *Characters of the trypanosome infecting Horse B.* We had no opportunity of examining this trypanosome in fresh preparations of the blood.

In stained preparations, the parasites found were invariably short and non-flagellated, the undulating membrane being but slightly developed, and the body of the creature prolonged to the extremity of the flagellum. Nucleus oval and central, blepharoplast terminal or latero-terminal. The length of 100 trypanosomes varied from 10 μ to 16·9 μ, with an average of 12·9 μ. No free flagellated forms were met with in the blood of this horse, but it must be remarked that we were only in a position to examine films made on a single day of the infection.

TABLE II. Summary of results of inoculations of the parasite from *Horse A* into Laboratory Animals



– Signifies that the animal did not become infected : + that the animal became infected.

III. RESULTS OF INOCULATION INTO LABORATORY ANIMALS

A. *Animals inoculated from Horse A.* Two rats and two mice inoculated from this horse, at a time when the peripheral blood contained trypanosomes in fair numbers (three to a field, objective DD, ocular No. 4), failed to become infected. Two of four guinea-pigs, and two of three rabbits inoculated with the animal's blood became infected. Two goats showed parasites on the eleventh and fourteenth day respectively, after inoculation. The results of the inoculations made from these animals are given in Table II.

As will be seen from this table, the rats and mice inoculated directly from the horse, and those sub-inoculated with the trypanosome after passage through a goat were all refractory. This applies also to those rats and mice inoculated with the parasites after a second passage through goats. Rats and mice sub-inoculated from a rabbit infected directly from the horse contracted the disease, and from one of these mice a further series of rats and mice was with difficulty infected.

In Table III are given details of our experimental inoculations into laboratory animals.

B. *Animals inoculated from Horse B.* We understand from Sir John MacFadyean that mice inoculated from this horse were easily infected. From a mouse received from him infected with this strain we found that goats, rabbits, guinea-pigs, dogs, rats and mice were easily infected. In mice the incubation period averaged five days and death occurred on the fourteenth day.

IV. MORPHOLOGY OF THE TRYPANOSOMES IN VARIOUS LABORATORY ANIMALS.

Trypanosomes from Horse A. The trypanosome found in goats resembled in every respect that occurring in the blood of the horse. They were all long (17 μ to 26·6 μ), free flagellated forms, with the exception of very occasional short (14 μ to 15 μ) non-flagellated forms. In Rabbit 1467 the parasites averaged from 20·2 μ to 21·7 μ in length, until the day on which death occurred, when only short forms of an average length of 14·7 μ were encountered. In Rabbit 1494, also inoculated directly from the horse, only short forms, with an average length of 11·3 μ to 13·1 μ were found. Similarly only short non-flagellated trypanosomes were met with

TABLE III.– Pathogenicity of the Trypanosome from *Horse A* in Laboratory Animals

No. of Experiment	Animal from which inoculated	Day on which parasites first found in blood	Day on which death occurred	Remarks
Horse A	Unknown	Unknown	June 24th, 1911	
1608 A	Mouse 1535 A	15th	—	Alive on 21st day
GOATS				
1485	Horse A	12th	26th	
1497	,,	10th	44th	
1559	Goat 1497	11th	—	Alive on 60th day
1584	Mouse 1535 B	—	—	Alive on 46th day, parasites never seen
1605	Goat 1559	9th	—	Alive on 30th day
RABBITS				
1467	Horse A	23rd	36th	
1489	,,	—	—	Alive on 110th day ; parasites never seen
1494	,,	19th	—	Alive on 102nd day
1604	Goat 1559	16th	—	Alive on 32nd day
GUINEA-PIGS				
1490	Horse A	—	64th	Parasites never found in blood
1495	,,	19th	22nd	
1519	,,	—	52nd	Parasites never found
1520	,,	18th	—	Alive on 92nd day
DOGS				
1524	Goat 1485	11th	20th	
1553 A	,, 1497	—	—	Alive on 55th day ; parasites never seen
1553 B	,, 1559	—	—	Alive on 48th day ; parasites never seen
1609	,, 1605	—	—	Alive on 20th day ; parasites never seen

TABLE III.—*continued*—Pathogenicity of the Trypanosome from *Horse A* in Laboratory Animals

No. of Experiment	Animal from which inoculated	Day on which parasites first found in blood	Day on which death occurred	Remarks
RATS				
1465	Horse A	—	9th	Parasites never seen
1466	,,	—	6th	,, ,,
1496	,,	—	4th	,, ,,
1526 A	Goat 1407	—	—	Alive on 65th day; parasites never seen
1526 B	,,	—	—	,, ,,
1526 C	,,	—	—	,, ,,
1532 A	,,	—	—	,, ,,
1532 B	,,	—	—	,, ,,
1534	Rabbit 1467	6th	23rd	Few parasites on two days only
1582 A	Goat 1550	—	30th	Parasites never seen
1582 B	,,	—	36th	,,
1582 C	,,	—	—	Alive on 36th day: parasites never seen
1582 D	,,	—	—	,, ,,
1582 E	,,	—	—	,, ,,
1582 F	,,	—	—	,, ,,
1586 A	Mouse 1535 B	25th	—	Alive on 45th day; parasites never seen
1586 B	,,	—	25th	Parasites never seen
1608 B, 1	Mouse 1535 A	8th	—	Alive on 20th day
1608 B 2	,,	—	—	Alive on 20th day; parasites never seen
1608 B, 3	,,	—	14th	Parasites never seen
1610 A	Pup 1553	—	18th	,,

TABLE III.—*continued*—Pathogenicity of the Trypanosome from *Horse A* in Laboratory Animals

No. of Experiment	Animal from which inoculated	Day on which parasites first found in blood	Day on which death occurred	Remarks
MICE				
1498 A	Horse A	—	6th	Parasites never seen
1498 B	,,	—	5th	,,
1527 A	Goat 1497	—	8th	,,
1527 B	,,	—	—	Alive on 90th day; parasites never seen
1535 A	Rabbit 1467	18th	—	Killed for inoculation on 58th day
1535 B	,,	3rd	—	Killed for inoculation on 32nd day
1583 A	Goat 1559	—	7th	
1583 B	,,	—	7th	Parasites never seen
1583 C	,,	—	—	Alive on 47th day
1585 A	Mouse 1535 B	—	30th	Parasites never seen
1585 C	,,	—	24th	,,

TABLE IV.—Pathogenicity of the Parasite from *Horse B* in Laboratory Animals

No. of Experiment	Animal from which inoculated	Day on which parasites first found in blood	Day on which death occurred	Remarks
GOATS				
1587	Mouse 1562 A	13th	—	Alive on 46th day
DOGS				
1624	Goat 1587	7th	—	Alive on 12th day
RABBITS				
1603	Goat 1587	8th	—	Alive on 30th day
GUINEA-PIGS				
1620	Goat 1587	8th	—	Alive on 12th day

TABLE IV.—*continued*—Pathogenicity of the Parasite from *Horse B* in Laboratory Animals

No. of Experiment	Animal from which inoculated	Day on which parasites first found in blood	Day on which death occurred	Remarks
RATS				
1618 A	Goat 1587	9th	—	Alive on 12th day
1618 B	,,	8th	—	,,
MICE				
1554	Mouse (Sir J. Mc.)	5th	10th	
1562 A	Mouse 1554	6th	14th	
1562 B	,,	5th	14th	
1514	Mouse 1562 A	5th	18th	
1619 A	Goat 1587	4th	—	Alive on 11th day
1619 B	,,	5th	—	,,

in the blood of infected guinea-pigs. A pup inoculated from one of the goats showed only short (10·9 μ to 18·7 μ) non-flagellated forms. Only short (9·6 μ to 18 μ) non-flagellated trypanosomes were found in the blood of a rat and two mice sub-inoculated from one of the rabbits.

A detailed account of the measurements of the trypanosomes in various animals experimentally infected is given in Table V.

It will be seen from this table that the parasite varies morphologically in different animals, and sometimes even in the same animal on different days of the infection, in a most remarkable manner.

Trypanosome from Horse B. The trypanosomes found in the blood of mice infected with this strain were short (10·4 μ to 18 μ) non-flagellated, and were similar in appearance to those occurring in the blood of mice infected with *Horse A* strain. Dogs sub-inoculated from the mice contained trypanosomes varying in length from 10 μ to 19 μ, and in rabbits inoculated from the same source the trypanosomes varied from 9·5 μ to 15·2 μ.

In the blood of goats inoculated from the mice the trypanosomes measured from 10·9 μ to 18 μ.

Table VI shows the measurement of the trypanosome in animals infected with this strain.

TABLE V.—Length of the Trypanosome from *Horse A* in Laboratory Animals on various days of the infection

GOATS

No. of Experiment	Animal from which inoculated	Day of disease	No. measured	Measurement in μ			Remarks
				Maximum	Minimum	Average	
1485	Horse A	17th	20	22·8	16·6	20·5	
,,	,,	19th	40	25·4	18·6	22·3	
,,	,,	21st	20	24·7	14·7	20·5	
,,	,,	26th	20	26·0	17·6	22·3	Day of death
		Total ...	100	26·0	14·7	21·6	
1497	Horse A	32nd	50	25·7	14·7	21·7	
,,	,,	34th	20	24·2	19·0	22·3	
,,	,,	37th	60	26·6	17·8	21·3	
,,	,,	46th	50	23·8	19·5	21·5	
		Total ...	180	26·6	14·7	21·6	

TABLE V.—*continued*—Length of the Trypanosome from *Horse A* in Laboratory Animals on various days of the infection

RABBITS

No. of Experiment	Animal from which inoculated	Day of disease	No. measured	Measurement in μ			Remarks
				Maximum	Minimum	Average	
1467	Horse A	25th	40	25·0	12·7	21·7	Parasites first found in the blood on the 18th day
,,	,,	33rd	20	22·3	18·5	20·2	
,,	,,	34th	60	23·2	17·4	20·9	
,,	,,	36th	50	18·5	10·9	14·7	Day of death
		Total ...	170	25·0	10·9	19·2	
1494	Horse A	38th	20	15·7	10·4	13·1	
,,	,,	40th	20	14·7	9·2	11·3	
		Total ...	40	15·7	9·2	12·2	

TABLE V.—*continued*—Length of the Trypanosome from *Horse A* in Laboratory Animals on various days of the infection

Dogs

No. of Experiment	Animal from which inoculated	Day of disease	No. measured	Measurement in μ			Remarks
				Maximum	Minimum	Average	
1524	Goat 1485	12th	20	17·6	11·1	13·4	
,,	,,	13th	25	16·1	10·9	13·7	
,,	,,	14th	20	17·3	11·1	13·8	
,,	,,	15th	40	18·7	12·3	14·9	
,,	,,	16th	20	18·3	10·4	13·9	
,,	,,	17th	20	15·2	11·4	13·2	
,,	,,	18th	30	17·6	10·9	13·7	
		Total ...	175	18·7	10·4	13·9	

TABLE V.—*continued*—Length of the Trypanosome from *Horse A* in Laboratory Animals on various days of the infection

RATS

No. of Experiment	Animal from which inoculated	Day of disease	No. measured	Measurement in μ			Remarks
				Maximum	Minimum	Average	
1534	Rabbit 1467	14th	20	14·7	9·5	12·3	
..	..	14th	30	16·1	9·5	13·1	
		Total ...	50	16·1	9·5	12·8	

MICE

1535 A	Rabbit 1467	19th	20	12·5	9·6	11·8	Parasites first found in the blood on the 18th day
..	..	23rd	40	18·0	11·4	13·9	
..	..	27th	20	18·0	11·1	13·5	
1535 B	..	5th	5	15·4	11·9	13·4	
		Total ...	85	18·0	9·6	13·?	

TABLE VI.—Length of the Trypanosome from *Horse B* in Laboratory Animals on various days of the infection

GOATS

No. of Experiment	Animal from which inoculated	Day of disease	No. measured	Measurement in μ			Remarks
				Maximum	Minimum	Average	
1587	Mouse 1562 A	27th	25	16·6	11·9	14·2	Parasites first found in blood on 13th day
,,	,,	27th	25	16·1	11·9	14·2	
,,	,,	23rd	25	18·0	11·4	14·1	
,,	,,	35th	25	16·6	10·9	14·3	
		Total ...	100	18·0	10·9	14·2	
DOGS							
1624	Goat 1587	8th	50	17·6	10·0	14·1	Parasites first found in blood on 7th day
,,	,,	9th	50	19·0	10·9	13·5	
		Total ...	100	19·0	10·0	13·8	
RABBITS							
1603	Goat 1587	30th	20	15·2	9·5	12·4	

TABLE VI.—*continued*—Length of the Trypanosomes from *Horse B* in Laboratory Animals on various days of the infection

GUINEA-PIGS							
1620	Goat 1587	13th	10	13·8	9·5	12·0	
RATS							
1618 B	Goat 1587	18th	50	16·6	10·4	13·0	
,,	,,	10th	50	19·0	9·5	12·9	
		Total ...	100	19·	9·5	12·9	
MICE							
1554	Mouse infected from Horse B	5th	20	15·7	10·4	13·0	Parasites first found in blood on 5th day
,,	,,	5th	20	17·6	11·1	13·7	
,,	,,	8th	20	17·6	10·9	14·3	
,,	,,	8th	20	18·0	11·4	14·2	
		Total ...	80	18·0	10·4	13·8	

V. COMPARISON OF THE TRYPANOSOMES IN THE TWO HORSES

The fact that the trypanosome occurring in *Horse A* is morphologically distinct from that present in films made from the blood of *Horse B* on its arrival in England—both animals being naturally infected in the Gambia—appears to us to be one of considerable interest. The morphological distinction, as we have previously stated, consists in the fact that whereas the trypanosomes infecting *Horse A* were almost invariably free flagellated and uniform in length (average length 20·6 μ), those observed in the blood of *Horse B* were short and without free flagellum.

A second point of interest is that the trypanosomes found in the blood of certain laboratory animals (dog, guinea-pig, rat and mouse), inoculated with the strain derived from *Horse A*, in no way resembled the majority of the parasites present in the blood of this horse. The trypanosome in these animals was short and non-flagellated, and its measurements corresponded closely to those of the parasite present in the blood of *Horse B*. No long free flagellated forms were at any time observed in the blood of these laboratory animals. On the contrary goats infected with the *Horse A* strain exhibited the long free flagellated forms, and only very exceptionally was a stumpy non-flagellar form seen. One of the rabbits infected from this horse was remarkable in that until the last day of the disease the blood contained, with the exception of very occasional short trypanosomes, only long free flagellated parasites. On the last day, however, none of the latter forms was noticed, but a large number of the short non-flagellar trypanosomes was present.

The question now arises, was *Horse A* infected with a single trypanosome capable under certain conditions of assuming a long free flagellum and under other conditions of existing in a non-flagellar state? Either this is so or this animal was infected with two distinct trypanosomes, one of which was a short non-flagellated trypanosome, and the other a long free flagellated trypanosome. The short trypanosome occasionally found in the blood of *Horse A* was similar, morphologically, to the parasite infecting *Horse B*. The point to be determined, therefore, is whether or no

the long forms infecting *Horse A* are of the same species as the short stumpy forms occurring in the same horse and in *Horse B*. We have endeavoured to decide this question experimentally. A series of laboratory animals, goats, dogs, guinea-pigs, rats and mice, inoculated with the blood of a mouse infected with the parasite from *Horse B*, became easily infected, and in all these animals the trypanosome retained its short character, no free flagellated forms being found. Next, the long free flagellated parasite from *Horse A*, as it appeared in the blood of a goat, was inoculated into a series of rats and mice. These sub-inoculated animals did not become infected. Again, the short forms derived from *Horse A*, as seen in the blood of an infected mouse, were inoculated into a horse, goat, rats and mice. Of these animals the goat gave a negative result, parasites never being found in its blood, and test animals—dog, rat, mouse—inoculated with large amounts of its blood, not becoming infected. Some of the mice and rats had a few parasites in the blood for one or two days only; the horse has had parasites for one day. In none of these animals, including the horse, have free flagellated trypanosomes been observed, short forms only, and these in very small numbers, appearing in their blood. Next, certain animals—rabbits, rats, mice—which had proved quite refractory to the parasites, long or short, derived from *Horse A* were inoculated with parasites derived from *Horse B*, and became easily infected. Further experiments are being done.

VI. IDENTITY OF THE TRYPANOSOMES

During the past few years several attempts have been made, for example, by Montgomery and Kinghorn (1908-9) and Laveran (1911), to classify the various pathogenic trypanosomes. Nevertheless, we are partly at a loss to assign a place in any of these classifications to the trypanosomes with which we are at present dealing.

We shall first consider the trypanosome found in the blood of *Horse B*. An examination of it leads one to associate this parasite with quite a definite group. Morphologically this trypanosome is closely allied to *T. dimorphon* in the sense in which the term is

used by Laveran and Mesnil. In its reaction upon laboratory animals also it corresponds definitely with this type of trypanosome. It falls, therefore, into that group which Bruce has designated by the term *T. pecorum*, in which he includes *T. dimorphon* (Laveran and Mesnil), *T. congolense* (Broden), *T. confusum* (Montgomery and Kinghorn), Edington's trypanosome from Zanzibar, the trypanosome from Chai-Chai (Theiler), and Bevan's trypanosome from Southern Rhodesia. We consider, therefore, that the trypanosome in the blood of *Horse B* is probably *T. dimorphon* (Laveran and Mesnil).

We take next the trypanosome infecting *Horse A*. From a study of the parasites in the blood of *Horse A* merely, one would naturally associate the trypanosome with that group of which *T. vivax* is a type, and in which Bruce (1910) has placed the *T. vivax* of Uganda, that from Togoland, the trypanosome from Pordage's ox, and also *T. cazalboui*. The reasons for associating the trypanosome as it appeared in the blood of *Horse A*, with the trypanosomes of this group are its extraordinary activity as seen in fresh preparations, and its morphological appearances in stained blood films, namely its uniformity in size, the peculiar shape of the body, the smallness of the membrane, and the presence of a free flagellum. The average length of this parasite is 20·6 μ, which is less than that given by Bruce for *T. vivax* (23·7 μ), but which corresponds very closely to the length of *T. cazalboui* (21 μ).

The view that this long form of parasite is closely akin to the *T. vivax* group is strengthened by observing the results of inoculations into laboratory animals, because we failed to find this form in the blood of dogs, guinea-pigs, rats and mice inoculated with the blood of *Horse A*, while a trypanosome whose appearance in fresh and stained preparations was identical with that of *Horse A*, was found in goats inoculated from this animal.

Against the view that this trypanosome from *Horse A* is *T. vivax*, we have the fact, mentioned above, that its length is less. In addition to this, however, the fact that we succeeded in infecting a rabbit with this form of trypanosome, militates against such a conclusion. Bruce,* in his paper on the diseases of domestic animals

* Bruce, *loc. cit.*

in Uganda, writes, in reference to *T. vivax*, 'This species of trypanosome is similar to *T. nanum*, in that it is only pathogenic to equines and bovines, and has no effect on the smaller laboratory animals.' Moreover, Laveran* in a recent paper, states that the rabbit, amongst other laboratory animals, is refractory to *T. cazalboui*. We recall here Bruce's statement† that it is probable that *T. vivax* and *T. cazalboui* are the same species.

We pass now to the consideration of the short forms of parasite found in small numbers in the blood of *Horse A*, and in the blood of goats inoculated from it, and in larger numbers in the blood of such dogs, rabbits, guinea-pigs, rats and mice as we succeeded in infecting from the horse or goats. Seen in fresh films of the blood of these animals, and studied in stained preparations, this parasite has considerable resemblance to the *T. pecorum* group.

Against the view that it is identical with *T. pecorum* is the fact that we succeeded in infecting guinea-pigs with the parasite. Bruce‡ found that guinea-pigs were refractory to *T. pecorum*, and Theiler (1909) observed that a trypanosome from Zululand, included by Bruce under the name *T. pecorum*, was also innocuous to guinea-pigs. Whether, however, the apparent insusceptibility on the part of a certain laboratory animal to infection with a trypanosome is sufficient ground for differentiating a parasite from similar trypanosomes known to infect such animal, appears to us to be a very doubtful question. Even the most recent literature contains contradictions on this point, e.g., Laveran§ states that *T. vivax* is pathogenic for the dog and rat. Further, attention has frequently been drawn to the fact that the virulence of a trypanosome can be considerably altered by passage through various animals.

But a glance at Table II will show that the short forms from *Horse A* are, up to now, at any rate, of a very low pathogenicity for several laboratory animals, especially noticeable, perhaps, in the case of mice, rats and dogs, and in this respect they differ entirely, not only from the short forms of parasite found in *Horse B*, but

* Laveran, *loc. cit.*

† Bruce, *T. vivax*, *loc. cit.*

‡ Bruce, *T. pecorum*, *loc. cit.*

§ Laveran, *loc. cit.*

also from our laboratory strains of *T. dimorphon* and *T. pecorum*. Even those animals which became infected, with the exception of a dog, had a chronic infection, and some appear to have recovered.

In regard then to the infection in *Horse A*, we find ourselves confronted by two possibilities—

1. *Horse A* is suffering from a double infection. One trypanosome resembles *T. vivax*, and the other resembles the *T. pecorum* group, but presents remarkable differences from this group in its pathogenicity to laboratory animals.

or

2. *Horse A* is infected with one trypanosome. This trypanosome resembles closely *T. vivax*. But if we are to accept this view, one's conception of *T. vivax* requires to be somewhat modified. In this connection, however, we know that Ziemann (1905) discovered short forms occasionally in *T. vivax* infection.

VII. CONCLUSION

1. We consider the trypanosome found in *Horse B* to be *T. dimorphon*, *sensu* Laveran and Mesnil.

2. The long form in *Horse A* appears to us to be *T. vivax*.

3. As regards the short form found in *Horse A*, we do not feel justified at the present stage in assigning its position. It may be a dimorphon-like trypanosome of low pathogenicity, or simply a modification of the long parasite of *Horse A*.

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DESCRIPTION OF PLATE XVIII

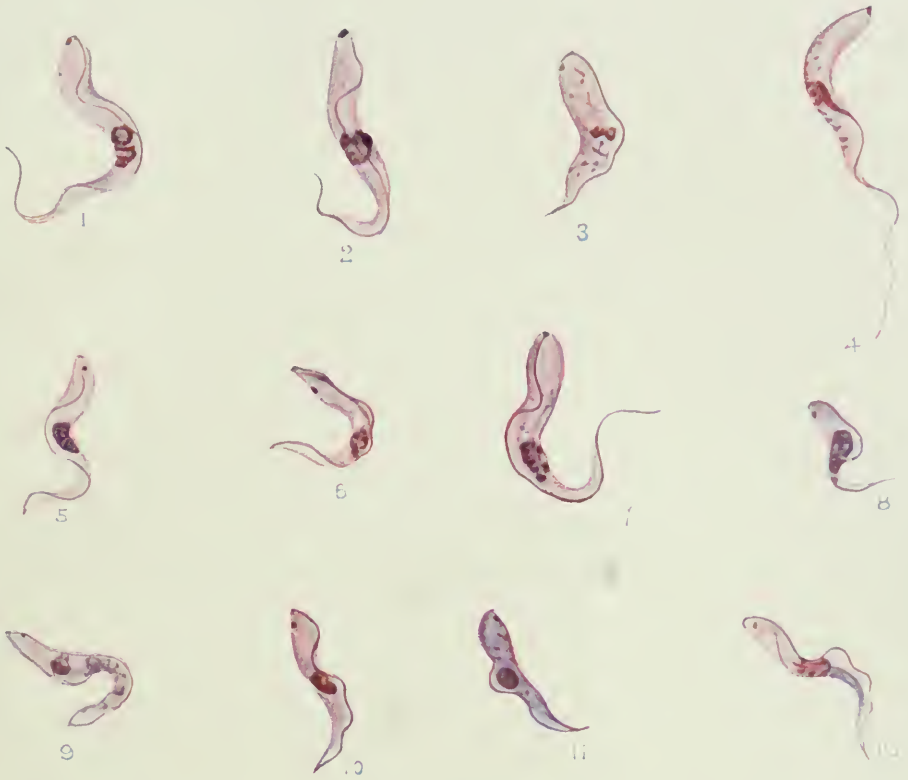
Films stained by Giemsa's method after fixing in absolute alcohol. Figures drawn with Abbé camera lucida, using 2 mm. apochromatic objective and No. 18 compensating ocular (Zeiss). Magnification reduced to 2000 diameters.

Trypanosomes from *Horse A* Strain

Figs. 1-3.—Parasites from *Horse A*.
Fig. 4.—Parasite from Goat.
Figs. 5, 6.—Parasites from Dog.
Figs. 7, 8.—Parasites from Rabbit.
Fig. 9.—Parasite from Guinea-pig.
Fig. 10.—Parasite from Rat.
Figs. 11, 12.—Parasites from Mouse.

Trypanosomes from *Horse B* Strain

Figs. 1-3.—Parasites from *Horse B*.
Fig. 4.—Parasite from Goat.
Fig. 5.—Parasite from Dog.
Fig. 6.—Parasite from Rabbit.
Fig. 7.—Parasite from Guinea-pig.
Figs. 8, 9.—Parasites from Rat.
Fig. 10.—Parasite from Mouse.



Horse A STRAIN

Horse B STRAIN

P. P. Press, Imp